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termination of rodents and not immunization by means of vaccines or serums.

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PELLAGRA INCIDENCE IN RELATION TO SEX, AGE, SEASON, OCCUPATION, AND "DISABLING SICKNESS" IN SEVEN COTTON-MILL VILLAGES OF SOUTH CAROLINA DURING 1916.[1]

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Introduction.

In the spring of 1916 we began a study of pellagra in certain cotton-mill villages of South Carolina. The results of that portion of the first year's study dealing with the relation of diet to pellagra incidence have already been reported.[2] In the present paper we desire to report the results of the part of the study dealing with the incidence of the disease in relation to certain social factors. Although a number of students have made somewhat similar studies, which we hope to review in a later paper, this, so far as we are aware, is the first time that the actual age and sex incidence of the disease have been determined for a population enumerated in direct connection with the study.

Locality and Population.

The study was made in seven representative cotton-mill villages situated in the northwestern part of South Carolina. The population of each was composed almost entirely of mill employees and their families. The few Negro families present and living in a quarter somewhat apart were not considered, so that our study deals with an exclusively white population which, with hardly a single exception, was of Anglo-Saxon stock, born in this country of American-born parents. We also excluded from our study the mill executives, store managers, clerks, and their households. There was, therefore, no significant difference in race or occupation (other than that of employment or nonemployment in the cotton mills) in the population (village people) studied.

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[1] From Field Investigations of Pellagra. Manuscript submitted for publication Feb. 5, 1920.
Goldberger, Wheeler, and Sydenstricker, 1920.

Methods of Study.

Pellagra incidence was determined, as described in a previous paper (*op. cit.*), by a biweekly house-to-house visit and search for cases. This was begun about the middle of April and carried on by one of us (G. A. W.) regularly every two weeks throughout the remainder of the year. This is believed to be the first time this expedient has been applied systematically and continuously over so long a period to the study of this disease.

At each canvass every family was visited and an effort made to see and question all individuals in or about the house. At first considerable reluctance was displayed by some of the people in speaking of any condition which they believed or suspected to be pellagrous; but as we became better known this reserve in large measure disappeared, so that from time to time cases were brought to our attention which might otherwise have escaped us.

In order to see as many as possible of those at work in the mill, the time of the canvass was so varied as to utilize more or less of the lunch hour and Saturday half-holidays in different villages and in different sections of the same village in rotation. At each visit inquiries were made as to the health of the absent members of the household and as to the existence of any suspicious illness or condition in the village, particularly in members of neighboring households. Reports regarded as suggestive were investigated, at times trips to the mill being made for this purpose.

Information with respect to the occurrence of cases of pellagra was also sought from local physicians. Although we believe we enjoyed their full cooperation, the number of cases coming to our attention in this way formed a very small proportion of the total recorded by us. This is interesting as indicating that but a small percentage of cases occurring in any season come to the attention of a physician.

Only those patients with a clearly defined bilaterally symmetrical dermatitis were recorded as having pellagra. In the course of the canvass, cases with manifestations more or less suggestive of the disease were from time to time encountered, but in the absence of a clearly marked bilaterally-symmetrical eruption were recorded at most as "suspects."

The date of the first appearance of the eruption was assumed to mark the onset of the attack. This date could be fixed fairly accurately in most adults, but was frequently rather difficult of determination in children, for it many times happened that in these the existence of an eruption was not recognized until attention was called to it in the course of the canvass. In such instances the date could frequently be placed as within the period of the immediately preceding two weeks by the fact of the absence of the eruption at the date of the preceding examination, or, in the event of the individual not having been seen at the immediately-preceding visit, the date could, as a rule, be placed as falling within the preceding four weeks. A definite date, however, so far as possible, was always assigned even in such instances. In selecting it, the appearance and stage of the eruption, with such other circumstances as the history of the case might bring out, were used as a guide. In general, it may be said that in the vast majority of our cases the date of "onset" is probably correct within less than a week, and in practically all cases it may be said that the eruption appeared not later than this date. It is possible that some of the cases recorded as occurring late in the year were really relapses, the eruption in the early part of the year having escaped our observation.

It is recognized that in assuming that the appearance of the eruption marks the onset of the attack of pellagra a certain error is involved. In many of our cases a definite history of symptoms antedating the eruption was obtained; in a much greater proportion (children for the most part), however, such history either could not be elicited or it was so vague as to be of no value in fixing the date of onset. In the latter event the assumption that the first appearance of the eruption marks the onset of the disease was, therefore, practically unavoidable; hence, for the sake of uniformity and in order to eliminate any possible bias, this rule was adopted and applied in all cases. It follows, therefore, that our "date of onset" should be interpreted as indicating that the attack began "not later than" that date.

In computing the incidence of pellagra among the total population studied, as well as the general incidence according to sex, age, occupation, and month of onset, all cases as defined above were considered without regard to the locality in which the onset of the 1916 attack occurred and without regard to the question of whether the 1916 attack was the initial or a recurrent attack.

The data relating to population were secured by a census of the villages made during May and June, 1916. The population is as nearly as possible that which was observed for pellagra prevalence. In some of the tabulations which are presented care has been taken to consider only those households which were under biweekly observation for specified periods.

The population of the several villages used in computing incidence according to sex, age, and occupation is slightly less than the total population, for the reason that data for some of the households and for some individuals were incomplete in these and some other respects, and hence could not be used. The total population of the seven villages enumerated in May and June, 1916, and used for the computation of pellagra incidence was 4,399, while the population used in computing sex, age, and occupation incidence aggregated 4,161.

Pellagra Incidence.

TOTAL INCIDENCE.

A total of 115 definite cases was recorded in the seven villages during the period April 16–December 31, 1916, representing a rate of 26.1 per 1,000 of population. These cases occurred in 77 households, so that on the basis of a total of 798 white mill workers' households, it appears that 9.6 per cent of these included some one or more members with a definite attack of pellagra in 1916.

There were recorded also 73 cases in which the eruption did not conform fully with the criteria we had adopted. These are some of the "suspects" to which previous reference has been made. We are satisfied that all of these may properly be classed as pellagra. If this were done, we would have a total of 188 cases and an incidence rate of 42.7 per 1,000 of population, a rate which is probably more closely representative of the actual condition than is that for our definite cases alone. As it has seemed wiser, however, to adhere strictly to our definition of pellagra, we have segregated these from our definite cases (see Table I) and have not considered them in relation to any of the factors that we have attempted to study.

TABLE I.—*Total pellagra incidence in white population of seven cotton-mill villages of South Carolina during 1916.*

[Households and population as enumerated in May and June, 1916.]

Mill village.	Households.					Persons.				
	Number considered.	With definite cases.		With ill-defined cases only.		Number considered.	With definite cases.		With ill-defined cases.	
		Number.	Per cent.	Number.	Per cent.		Number.	Per 1,000.	Number.	Per 1,000.
At	114	9	7.9	8	7.0	579	14	24.2	8	13.8
In	118	30	25.4	15	12.7	681	46	67.6	26	38.2
Ny	133	1	.8	2	1.5	750	1	1.3	2	2.7
Rc	100	13	13.0	11	11.0	603	19	31.5	12	19.9
Sn	131	6	4.6	7	5.3	642	8	12.5	7	10.9
Sa	85	7	8.2	6	7.1	504	15	29.7	9	17.9
Wy	117	11	9.4	5	4.3	640	12	18.7	9	14.1
All villages	798	77	9.6	54	6.8	4,399	115	26.1	73	16.6

It may here be noted that the number of cases recorded by us is believed to represent pretty closely, though perhaps not quite fully, the total incidence for the year, even though the search for cases did not begin until about the middle of April or the 1st of May. Subsequent experience has shown that but few cases develop during the first three months of the year in the locality studied; and as it is highly probable that a considerable proportion of the few developing earlier in the year would have continued active into the period when our canvass for cases began, the number missed was probably too small to affect the general rate very materially.

INCIDENCE ACCORDING TO SEX AND AGE.

The incidence of the disease during 1916 among persons of different sexes and of various age periods is shown in Table II. The ages in this table are grouped according to the conventional divisions—by single years up to 5, and by 5-year periods up to 65 years.

TABLE II.—*Pellagra incidence by sex and age in seven cotton-mill villages of South Carolina during 1916.*

[Definite cases in white population.]

Age periods.	Males.			Females.			Total.		
	Number.	Pellagrins.		Number.	Pellagrins.		Number.	Pellagrins.	
		Number.	Per 1,000.		Number.	Per 1,000.		Number.	Per 1,000.
Under 1 year	65	0	0.0	63	0	0.0	128	0	0.0
1 year	57	0	.0	56	0	.0	113	0	.0
2 years	59	0	.0	54	5	92.6	113	5	44.2
3 years	82	2	24.4	74	5	67.6	156	7	44.9
4 years	76	1	13.2	62	3	48.4	138	4	29.0
Under 5	339	3	8.8	309	13	42.1	648	16	24.7
5–9	313	20	63.9	296	15	50.7	609	35	57.5
10–14	279	5	17.9	258	4	15.5	537	9	16.8
15–19	242	2	8.3	279	3	10.8	521	5	9.6
20–24	221	1	4.5	234	12	51.3	455	13	28.6
25–29	156	0	.0	180	5	27.8	336	5	14.9
30–34	131	1	7.6	139	8	57.6	270	9	33.3
35–39	119	1	8.3	116	5	43.1	235	6	25.5
40–44	81	1	12.3	76	5	65.8	157	6	38.2
45–49	63	0	.0	59	3	50.9	122	3	24.6
50–54	46	1	21.7	45	1	22.2	91	2	22.0
55–59	32	1	31.2	40	0	.0	72	1	13.9
60–64	16	2	125.0	19	0	.0	35	2	57.1
65 years and over	33	2	60.6	39	1	25.6	72	3	41.7
All ages	**2,071**	**40**	**19.3**	**2,089**	**75**	**35.9**	**4,160**	**115**	**27.6**
Under 15 years	931	28	30.1	863	32	37.1	1,794	60	33.4
15 years and over	1,140	12	10.5	1,226	43	35.1	2,366	55	23.2

This tabulation suggests that certain age periods may be further grouped according to the incidence curves for the two sexes. This has been done in Table III and Fig. 1.

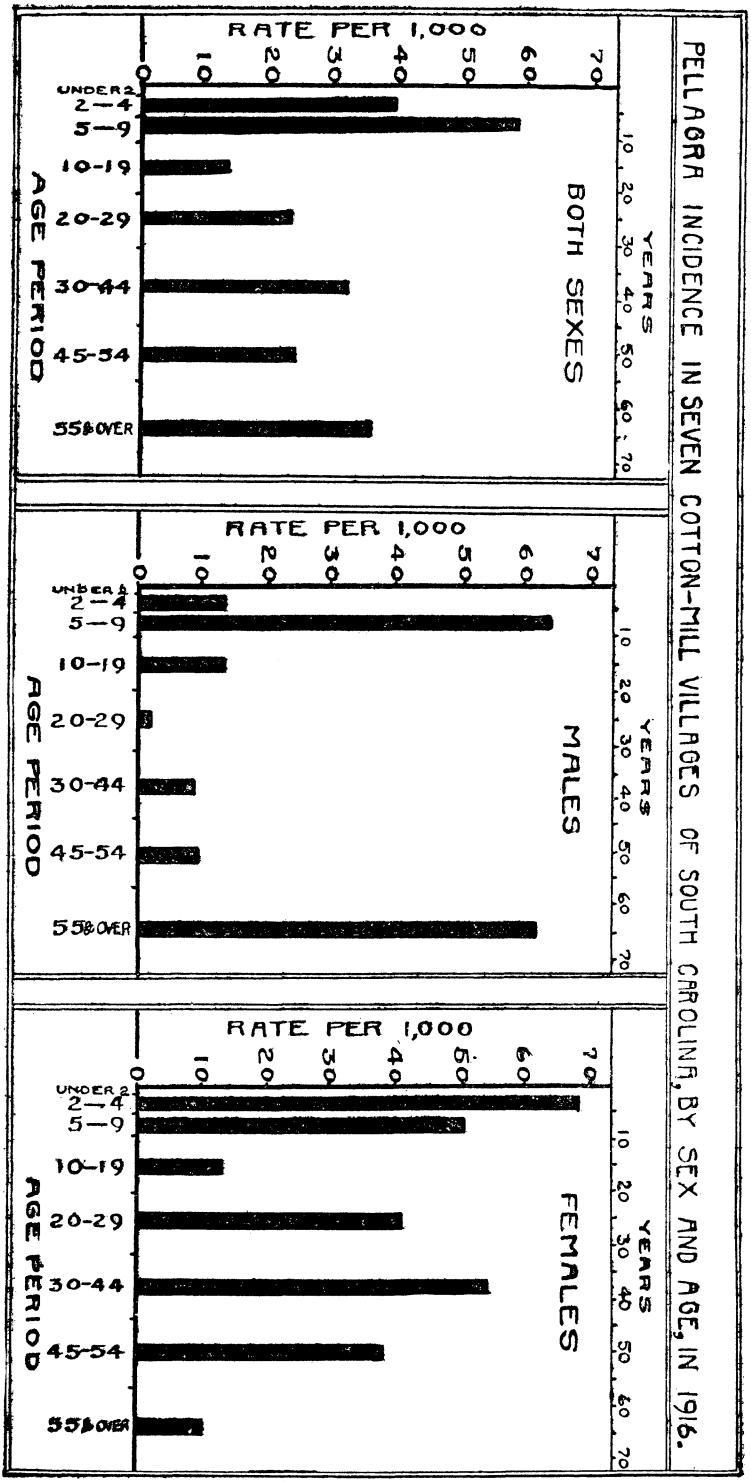
PELLAGRA INCIDENCE IN SEVEN COTTON-MILL VILLAGES OF SOUTH CAROLINA, BY SEX AND AGE, IN 1916.
BOTH SEXES
MALES
FEMALES
RATE PER 1,000
0
10
20
30
40
50
60
70
YEARS
AGE PERIOD
UNDER 2
2—4
5—9
10-19
20-29
30-44
45-54
55 & OVER

FIG. 1.

TABLE III.—*Pellagra incidence by sex and age in seven cotton-mill villages of South Carolina during 1916.*

[Definite cases in white population, the ages being classified into such periods as indicate the greatest variations.]

Age periods.	Males.			Females.			Total.		
	Number.	Pellagrins.		Number.	Pellagrins.		Number.	Pellagrins.	
		Number.	Per 1,000.		Number.	Per 1,000.		Number.	Per 1,000.
Under 2	122	0	.0	119	0	.0	241	0	.0
2- 4	217	3	13.8	190	13	68.5	407	16	39.3
5- 9	313	20	63.9	296	15	50.7	609	35	57.5
10-19	521	7	13.4	537	7	13.0	1,058	14	13.2
20-29	377	1	2.7	414	17	41.1	791	18	22.8
30-44	331	3	9.1	331	18	54.4	662	21	31.7
45-54	109	1	9.2	104	4	38.5	213	5	23.5
55 years and over	81	5	61.7	98	1	10.2	179	6	33.5
All ages	**2,071**	**40**	**19.3**	**2,089**	**75**	**35.9**	**4,160**	**115**	**27.6**

If the population of the pellagrous households alone—that is, of only those households in which definite cases of pellagra occurred in 1916—is considered, the variations in incidence (per cent) according to sex and age in this population appear to be similar to the variations indicated by the rate per 1,000 of the entire population censused, as may be seen by comparing Tables III and IV.

TABLE IV.—*Pellagra incidence by sex and age among members of white pellagrous households in seven cotton-mill villages of South Carolina during 1916.*

Age.	Total.			Males.			Females.		
	Number of persons.	Number of pellagrins.[1]	Per cent pellagrins.	Number of persons.	Number of pellagrins.[1]	Per cent pellagrins.	Number of persons.	Number of pellagrins.[1]	Per cent pellagrins.
Under 5	67	14	21.0	24	3	12.5	43	11	25.6
5- 9	79	31	39.2	41	16	39.0	38	15	39.5
10-19	114	13	11.4	65	6	9.2	49	7	14.3
20-29	46	13	28.3	22	0	.0	24	13	54.2
30-44	70	20	28.6	37	3	8.1	33	17	51.5
45-54	16	3	18.8	12	1	8.3	4	2	50.0
55 and over	12	3	25.0	6	2	33.3	6	1	16.7
All ages	**404**	**97**	**24.0**	**207**	**31**	**15.0**	**197**	**66**	**33.5**

[1] Only those pellagrins are considered who had been members of the household regularly (i. e., exclusive of transient persons and of pellagrins the onset of whose 1916 attacks occurred in other households).

Table IV, showing the number and per cent of members of different sexes and ages in pellagrous households who were affected with pellagra, is significant because it indicates pellagra incidence according to sex and age among persons living under generally closely similar household conditions. It will be observed that the ratio of female to male pellagrins among persons of all ages is about 2 to 1; this ratio varies considerably at different age periods, as is shown in the following:

Ratio of female to male pellagrins in population of white pellagrous households.

Age.	Per cent of members of pellagrous households who were affected with pellagra.		Ratio of female to male pellagra rate.
	Male.	Female.	
Under 5	12.5	25.6	2.0
5-9	39.0	39.5	1.0
10-19	9.2	14.3	1.6
20-44	6.9	27.4	4.0
45-54	8.3	50.0	6.0
55 and over	33.3	16.7	.5
All ages	**15.0**	**33.5**	**2.2**

Before attaching significance to these variations, consideration should be given to the possibility of their being due entirely or in part to irregularities arising from the relatively slight amount of data. Furthermore, since pellagra incidence is closely related to the household diet and tends to occur by households rather than by individuals in a considerable proportion of instances, the age and sex composition of the households affected may influence materially the rate in a given age period. In those age periods when the distribution of the sexes tends to be very nearly equal, as in the adult periods up to old age, the possible effect of such a condition is slight. But among children, especially young children, and among old persons, the effect of this condition upon the rate per 1,000 may be considerable. The number of our pellagrous families actually is small, and individual families may "run to" boys or to girls; and among old persons in households affected there may chance to be a predominance of widowed or deserted men or women.

A scrutiny of our family schedules indicates that at least one of the variations in incidence according to sex is due to irregularities of this type. In the age period "under 5 years" the rate for females, as indicated in Table II, is 42.1 per 1,000, as against only 8.8 for males. The pellagrins in this group were in 16 households, for 14 of which detailed data are available. The following are the statistics for these 14 households:

	Male.	Female.
(A) Total population "under 5 years"	5	15
(B) Number of pellagrins "under 5 years"	3	11
Per cent (B) of (A)	60	73

It appears, therefore, that the ratio of total males to male pellagrins and the ratio of total females to female pellagrins in the households affected by pellagra-causing conditions (allowing for the small numbers) was much the same and that there was, therefore, no real indication of a significant difference in incidence in the two sexes in this age period.

With these limitations in mind, the data appear to indicate that (1) the disease is rare at the age of 2 and under—no case in this age period was observed in the population studied during 1916; (2) among both males and females up to 20 years the incidence is similar, being higher among children between 2 and 10 years than in persons of the ages of 10 to 19, inclusive; and (3) among adults 20-54 years old the incidence is many times higher in females than in males.

These indications are in harmony with the results of other previous studies (Boudin 1861; Siler, Garrison, and MacNeal 1915). A discussion of their significance is reserved for a later communication.

Monthly (or Seasonal) Incidence.

In computing the incidence of 1916 attacks according to month (or season) of onset for all persons affected with pellagra, and in relation to their sex and age, each case of pellagra has been credited to the month in which the eruption appeared. In order to determine the monthly incidence as accurately as possible, the number of cases credited to each month has been adjusted to a 31-day month basis, and the monthly indices have been computed with the monthly average for the year as the basis.

Table V shows the actual number of cases the onset of which occurred in each month, as well as the relative number after adjustment is made to a 31-day month, for males and females and for both sexes. The relative number has been plotted in Fig. 2.

TABLE V.—*Monthly incidence of pellagra during 1916 in seven cotton-mill villages of South Carolina, actual number of definite cases for each sex, with onset in specified months, and the monthly percentage of cases after adjustment to a 31-day month.*

Month.	Males.			Females.			Total.		
	Number of cases.	Number of cases adjusted to 31-day month.	Monthly percentage of cases.	Number of cases.	Number of cases adjusted to 31-day month.	Monthly percentage of cases.	Number of cases.	Number of cases adjusted to 31-day month.	Monthly percentage of cases.
January	0	0	0	0	0	0	0	0	0
February	0	0	0	1	1.1	1.4	1	1.1	0.9
March	3	3	7.4	1	1.0	1.3	4	4.0	3.4
April	6	6.2	15.3	7	7.2	9.5	13	13.4	11.5
May	7	7.0	17.1	13	13.0	17.1	20	20.0	17.1
June	12	12.4	30.3	25	25.8	33.9	37	38.2	32.7
July	3	3.0	7.4	15	15.0	19.7	18	18.0	15.4
August	1	1.0	2.4	7	7.0	9.2	8	8.0	6.8
September	6	6.2	15.3	4	4.1	5.4	10	10.3	8.8
October	1	1.0	2.4	2	2.0	2.6	3	3.0	2.6
November	1	1.0	2.4	0	0	0	1	1.0	.9
December	0	0	0	0	0	0	0	0	0
Total	40	40.8	100	75	76.2	100	115	117	100
Monthly average	......	3.4	....	......	6.4	....	......	9.8	....

As may be seen, there was a sharp rise in incidence during April and May, reaching a well-defined peak in June. This was followed by an abrupt decline during July and August which was halted during September, but was resumed quite sharply during October. The season of onset appeared to be confined almost entirely to the six months, April to September, inclusive, and the period of greatest incidence clearly within the four months, April to July, inclusive. This agrees fairly well with the observations reported by other workers.

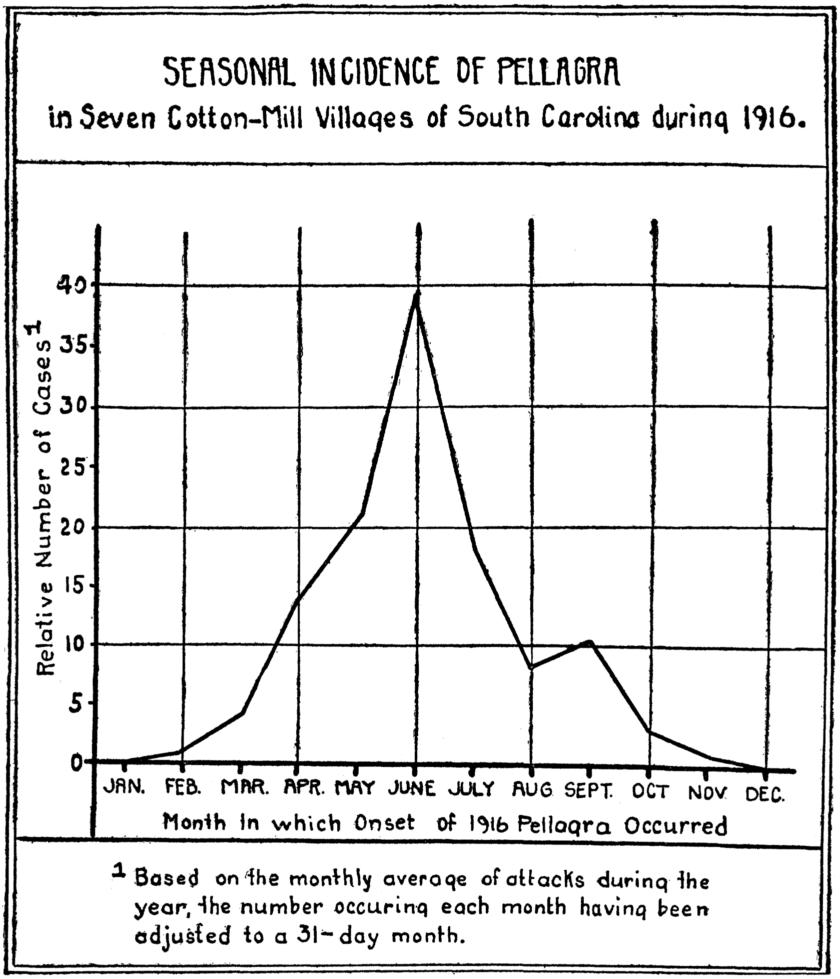

FIG. 2.

It should be observed that the data refer to monthly incidence ("onset") of attack and not to prevalence, since the duration of the attacks was not noted.

The monthly incidence of attacks among males and females appeared to be similar, with the exception of a secondary peak for males in September. The number of cases is too small, however, to warrant attaching significance to this irregularity. An examination of the detailed data shows that this was due to a predominance of males of the ages of 5 to 9 in two households affected with pellagra, and it may thus be regarded as accidental in a small group of individuals.

The possibility that seasonal incidence might vary among persons of different ages and of different family incomes was suggested by some tabulations made for experimental purposes, but, because of the necessity of subdivisions of the population into quite small groups, the results were not believed to be based on sufficient experience to warrant their presentation. The much larger experience afforded by our 1917 studies will, it is hoped, yield more satisfactory indications.

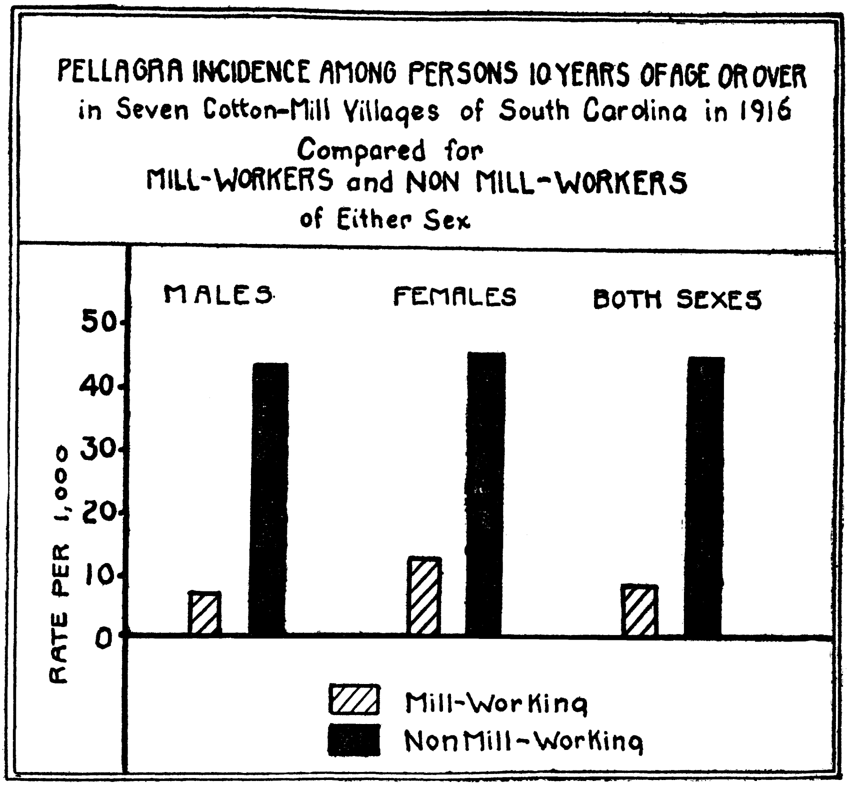

FIG. 3.

INCIDENCE ACCORDING TO OCCUPATION.

On the basis of occupation the population of the villages naturally falls into two classes, namely, mill workers and non-mill workers. Persons classified as mill workers were those who had been employed in the cotton mills during 1916 up to the date of the census, or, in the case of persons incapacitated by pellagra or other causes, up to the time of the incapacitation. With few exceptions, mill workers had been so employed prior to January 1, 1916, for periods varying in length, some as long as 10 or 15 years. The inclusion of all persons employed in the mills in a single group rather than in groups for specific occupations within the mill is made because (1) the occupations within the mill are for the great majority of persons similar in character and (2) because a considerable proportion of the operatives frequently change from one kind of work to another.

Persons classified as non-mill workers included all not classified as mill workers. In the case of children, these included those at home or at school, a few having been employed in millwork in 1915 during school vacation. In the case of adults, the females were housewives, with negligible exceptions; the males included those unable to engage in millwork or who were idle for some unascertained reason, and a very small number employed at other miscellaneous occupations.

In order to compare the incidence of the disease in these two classes, the members of which lived under the same general household and community conditions, Table VI was prepared. This, it may be seen, indicates that the pellagra rate among both males and females of all ages was considerably higher for the non-mill workers than for the mill workers. Since mill workers are all above the age of 10 years, the pellagra rates for the mill-working and the non-mill-working groups "10 years and over" afford a better basis of comparison. On this basis, the same condition is clearly indicated (Table VI and Fig. 3). As between the sexes the incidence among mill workers seems to follow pretty closely the corresponding general curves; that is, in the age group 10–19 years the rate for males is essentially the same as that for females; for the age groups 20–44 the rate for females is much higher than that for males. A comparison of the rates for the sexes, of those 10 years and over, of the non-mill-working group can hardly be made because of the small numbers among the males in all age groups save that between 10 and 19 years. For this age group the incidence was the same for both sexes.

TABLE VI.—*Pellagra incidence according to occupation among white persons of different sex and age in seven cotton-mill villages of South Carolina during 1916.*

Age period.	Mill working.			Non-mill working.		
	Number of persons.	Pellagrins.		Number of persons.	Pellagrins.	
		Number.	Per 1,000.		Number.	Per 1,000.
Males.						
All ages	1,186	8	6.7	885	33	37.3
10 years and over	1,186	8	6.7	233	10	42.9
Under 10	0	0	.0	652	23	35.3
10-19	358	3	8.4	165	4	24.2
20-29	362	1	2.8	13	1	76.9
30-44	321	3	9.3	10	0	.0
45-54	93	0	.0	15	1	6.7
55 years and over	52	1	19.2	30	4	13.3
Females.						
All ages	639	8	12.5	1,450	66	45.5
10 years and over	639	8	12.5	845	38	44.9
Under 10	0	0	.0	605	28	46.3
10-19	332	2	6.0	205	5	24.4
20-29	198	4	20.2	216	12	55.6
30-44	95	2	21.1	236	16	67.8
45-54	9	0	.0	95	4	42.1
55 years and over	5	0	.0	93	1	107.5
Total.						
All ages	1,825	16	8.8	2,335	99	42.4
10 years and over	1,825	16	8.8	1,078	48	44.5
Under 10	0	0	.0	1,257	51	40.6
10-19	690	5	7.3	370	9	24.3
20-29	560	5	8.9	229	13	56.8
30-44	416	5	12.0	246	16	65.0
45-54	102	0	.0	110	5	45.5
55 years and over	57	1	17.5	123	5	40.6

THE RELATION OF "DISABLING SICKNESS" TO PELLAGRA INCIDENCE.[1]

In connection with the inquiry relating to occupation, it seemed of interest to determine the relation of disabling sickness to pellagra incidence, and, accordingly, Table VII was prepared. This shows that while the pellagra rate among non-mill-working females was approximately four times as high as that among mill-working females, the rate for disabling sickness appears distinctly higher in mill-working than in non-mill-working females. Pellagra would seem, therefore, to have been a relatively unimportant element in the higher sickness rate among mill-working females, and, conversely, the disability indicated by the higher sickness rate among mill-working females appeared not to influence materially the pellagra rate in this group. This does not seem to afford any support for the view entertained by many observers that general debility is an essential predisposing factor in the production of pellagra.

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[1] Persons classified as "sick" were those who were "unable to work" on account of sickness or non-industrial accident. See also Sydenstricker, Wheeler, and Goldberger, 1918, where the definition of "disabling sickness" is given and more fully discussed.

TABLE VII.—*Cases of disabling sickness of less than three months' duration (exclusive of confinements), as ascertained by a census in May and June, 1916, and of pellagra during 1916, among non-millworking and millworking females between the ages of 10 and 45 in seven cotton-mill villages of South Carolina.*[1]

	Non-millworking.			Millworking.		
	Number of persons.	Cases.		Number of persons.	Cases.	
		Number.	Rate per 1,000.		Number.	Rate per 1,000.
Disabling sickness at date of census	664	26	39.2	619	28	45.2
Pellagra during 1916	657	33	50.2	625	8	12.8

[1] The actual rate of pellagra incidence during 1916 can not, of course, be compared with the rate of disabling illness as found for one day. The relative differences in rates according to occupation, however, are comparable, especially when the fact is taken into consideration that the majority of the pellagra cases had their onsets in May and June, the same months in which the census of disabling sickness was made.

Summary.

1. During 1916 the incidence of pellagra among the members of the families of white mill-operatives of seven representative cotton-mill villages of South Carolina was included in our study.

2. In a population of 4,399, a total of 115 definite cases, representing a rate of 26.1 per 1,000, was recorded. If 73 cases with ill-defined eruption recorded as "suspects" are included, there were in all 188 cases and an incidence rate of fully 42.7 per 1,000 in this population.

3. The data appear to indicate that the disease is rare in children at the age of 2 and under; that among both males and females up to 20 years the incidence is similar, being higher among children between 2 and 10 years than in persons of the ages of 10 to 19, inclusive; and that among adults 20–54 years old the incidence is many times higher in females than in males.

4. There was a sharp rise in incidence during April and May, reaching a well-defined peak in June. The season of onset appeared to be confined almost entirely to the six months, April to September, inclusive.

5. The pellagra rate among both males and females was considerably higher for the non-millworkers than for the millworkers.

6. While the pellagra rate among non-millworking females was approximately four times as high as that among millworking females, the rate for disabling sickness appeared distinctly higher in millworking than in non-millworking females. The disability indicated by the higher sickness rate among millworking females appeared not to influence materially the pellagra rate in this group.

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CAN THE MOSQUITO CONVEY INFECTION FROM A MALARIA PATIENT UNDERGOING TREATMENT?—DOES SPOROGONY AFFECT MOSQUITO LIFE?

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It is possibly of more than academic interest to consider the effect quinine exerts on the mature gametocyte when it is taken up and elaborated in the mosquito. Information on this matter would probably be of some value in determining how soon after beginning treatment a malaria patient is no longer a source of infection for mosquitoes, and it has a practical bearing on the problem of the necessity of isolating the patient by screening.

We know that although every case of malaria is a potential medium for the production of gametocytes, these sexual bodies do not develop until the malarial infection has persisted for several days—8 to 15 days in the case of subtertian malaria, and 7 to 10 days in tertian and quartan malaria—following the onset of definite symptoms of infection. We must appreciate the fact that the infection may be present for a considerable time before the patient gives tangible evidence of its occurrence, so that gametocyte production may be fairly started and the actual time required for the development of gametes may be longer than is generally accounted. It is even possible that the blood may contain at least partially grown parasites before distinct symptoms of malarial infection are noted. This is especially true of latent malaria, and often in these cases the patient harboring moderate numbers of plasmodia not only does not exhibit symptoms but is performing severe manual labor.

Several authorities have reported that after the gametes of the various types of plasmodia have reached maturity, quinine is ineffective in action so far as their development within the mosquito